CLAIMS

1. A mould, the mould (10, 40, 44, 46, 48, 52, 58, 62, 74, 80, 90, 100) comprising a first part (12) made of a first material, the first part (12) forming the mould surface (14); a second part (22, 24, 26) made of a second material of a relatively high thermal conductivity, which thermal conductivity is significantly greater than that of the first material; and a third part of a third material, the third part being interposed between the first and second parts, the third part being in the form of a relatively thin layer, the third material being of a type to form metallic bonds respectively with the first and second materials.

2. A mould according to claim 1, characterised in that the third material has a thermal conductivity which is not significantly less than the thermal conductivity of the first material.

3. A mould according to claim 2, characterised in that the thermal conductivity of the third material is greater than the thermal conductivity of the first material.

4. A mould according to any of claims 1 to 3, characterised in that the first material comprises steel.

5. A mould according to claim 4, characterised in that the first material comprises a tool, die or mould steel.

6. A mould according to claim 5, characterised in that the first material is of the through-hardenable, prehardened, case hardening, corrosion resistant or maraging type of steel.

7. A mould according to claims 5 and 6, characterised in that the first material comprises H13 or AISI 420.

8. A mould according to any of the preceding claims, characterised in that

the second material comprises copper or a copper alloy.

9. A mould according to claim 8, characterised in that the second material comprises a copper alloy having a thermal conductivity greater than 60$Wm^{-1}deg^{-1}C$.

10. A mould according to Claim 9, characterised in that the thermal conductivity is greater than 100$Wm^{-1}deg^{-1}C$.

11. A mould according to any of the preceding claims, characterised in that the third material comprises nickel or a nickel alloy.

12. A mould according to any of the preceding claims, characterised in that the second part is in the form of one or more inserts (22, 24, 26) locatable in one or more recesses (16, 18, 20) in the first part (12).

13. A mould according to any of the preceding claims, characterised in that the first part (12) provides a required minimum thickness of material for all of the mould surface (14).

14. A mould according to claim 13, characterised in that the required minimum thickness is 0.5mm.

15. A mould according to any of the preceding claims, characterised in that the third part is in the form of a coating on the first or second part or both.

16. A mould according to claim 15, characterised in that the coating is between 2 and 200μm thick.

17. A mould according to claims 15 and 16, characterised in that the coating is formed by electroplating and is 5 to 50μ m thick.

18. A mould according to claim 17, characterised in that the coating is

substantially 25μm thick.

19. A mould according to any of the preceding claims, characterised in that holes (28) are provided extending through at least the first part to permit ejector pins to extend therethrough for rejection of items from the mould (10), or for core pins or slides.

20. A mould according to any of the preceding claims, characterised in that passages (32) are provided extending through the first (12) and/or second (22, 24, 26) parts to permit cooling fluids and/or heating elements to extend therethrough.

21. A mould according to claim 20, characterised in that each passage (32) only passes through components made of the first or second material and not both.

22. A mould according to claims 20 or 21, characterised in that an insert (34) of the first material is provided in the second part (26) to receive a passage (32) from the first part (12), or vice versa.

23. A mould according to any of the preceding claims, characterised in that the mould comprises a number of cooperable parts, with each part being according to the invention.

24. A mould according to claim 23, characterised in that the first part (12) is made in two sections, a first section (12) which defines the mould surface (14), and a second outer section (46).

25. A mould according to claim 24, characterised in that the second section (46) is made of a different material or grade of material to the first section (12).

26. A mould according to any of claims 23 to 25, characterised in that insert members (50) are provided in the second part (26).

27. A mould according to claim 26, characterised in that the insert members (50) are of a material of lower thermal expansion than the second material.

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28. A mould according to claims 26 or 27, characterised in that the insert members (50) are of the first material.

29. A mould according to any of claims 23 to 28, characterised in that the first part (12) is in the form of a generally constant thickness layer (56) on the second member (54).

30. A mould according to claim 29, characterised in that the layer (56) is 1 to 8mm thick.

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31. A mould according to any of claims 23 to 30, characterised in that the part of the first part (12) which faces the second part and/or the part of the second part which faces the first part (12) have a relatively large surface area.

32. A mould according to claim 31, characterised in that formations are provided on said facing part or parts to increase the surface area.

33. A mould according to claim 32, characterised in that said formations comprise any of serrations, grooves or fins.

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34. A mould according to claims 32 or 33, characterised in that corresponding interengaging formations are provided on each of the first and second parts.

35. A method of making a mould, characterised in that the mould (10, 40, 44, 48, 52, 58, 62, 74, 80, 90, 100) is according to any of the preceding claims.

36. A method according to claim 35, characterised in that a composite blank of the first, second and third materials is produced, and then at least the first material is machined to produce a mould (40).

37. A method according to claim 36, characterised in that the mould (40) is substantially polished.

38. A method according to claims 36 or 37, characterised in that the composite blank is formed by locating the first, second and third materials together and subjecting to hot isostatic pressing to form metallic bonds respectively between the first and third, and second and third materials.

39. A method according to claim 38, characterised in that the pressing takes place in a sealed container.

40. A method according to claims 38 or 39, characterised in that the pressing takes place at a temperature of 400 to 1350°C.

41. A method according to any of claims 38 to 40, characterised in that the pressing takes place at a pressure of 400 to 3000 bar.

42. A method according to any of claims 39 to 41, characterised in that the sealed container is substantially evacuated of fluids prior to pressing.

43. A method according to claims 36 or 37, characterised in that the composite blank may be formed by locating the first, second and third materials together and subjecting to uniaxial pressing to form metallic bonds respectively between the first and third, and second and third materials.

44. A method according to any of claims 38 to 43, characterised in that the third part is applied on to the first (12) or second part by electroplating.

45. A method according to any of claims 38 to 43, characterised in that the third part is provided as a foil or applied by electroless plating.

46. A method according to any of claims 35 to 45, characterised in that the mould is heat treated before and/or after machining.

47. A method according to any of claims 35 to 46, characterised in that the second part may be formed by machining.

48. A method according to any of claims 35 to 47, characterised in that where the second part is in the form of one or more inserts (22, 24, 26) locatable in one or more cavities (16, 18, 20) in the first part (12), the second part is formed by filling the or each cavity (16, 18, 20) in the first part (12) with the second material in powder form, which powder forms the second part (22, 24, 26) during uniaxial or hot isostatic pressing.

49. A method according to any of claims 35 to 47, characterised in that where the second part (22, 24, 26) is in the form of one or more sheets locatable in one or more cavities in the first part, the second part (22, 24, 26) is cast in the or each cavity (16, 18, 20) in the first part (12).

50. A method according to claims 48 or 49, characterised in that the walls of the or each cavity (16, 18, 20) are initially coated with a layer of the third material.

51. A method according to claim 50, characterised in that the coating is greater than 25μm thick.

52. A method according to any of claims 35 to 51, characterised in that where the first part (12) is in the form of a substantially constant thickness layer, the underside (non-moulding surface) of the first part (12) is machined from a block of first material.

53. A method according to claim 52, characterised in that the second part (54) is subsequently located against the underside of the first part (12).

54. A method according to claim 53, characterised in that the second part (54) is cast either directly on to the first material with the third part already located thereon, or is cast separately.

55. A method according to claim 54, characterised in that the second material is formed by locating the second material in powder form on the first part (12) with the third part already located thereon, with the powder forming the second part (54) during hot isostatic or uniaxial pressing.

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56. A method according to claims 54 or 55, characterised in that once the second part (54) has been formed and bonded to the underside of the mould surface of the first part (12), the first part (12) is formed by machining.

57. A method according to any of claims 35 to 56, characterised in that the first part (12) is formed by hot isostatic or uniaxial pressing of powdered first material.

58. A method according to claim 57, characterised in that the powder is located against a former (78).

59. A method according to claim 58, characterised in that the former (78) is produced by rapid prototyping.

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60. A method according to claims 58 or 59, characterised in that the first part (84) is formed as a layer (84) between two formers (78, 82).

61. A method of forming a mould (80), the method comprising forming at least the part of the mould (80) which provides the mould surface by hot isostatic pressing a powder located against one or more formers (78, 82).

62. A method of forming a mould (80), the method comprising forming at least the part of the mould (80) which provides the mould surface by uniaxial pressing a powder located against one or more formers (78, 82).

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63. A method according to claims 61 or 62, characterised in that the former (78) is made of steel, graphite or ceramic.

64. A method according to claim 63, characterised in that these materials are machined from solid; sintered from powder; or cast.

65. A mould, the mould (62, 74, 90, 100) comprising a first part (70, 98) of a first erosion resistant material, the first part (70, 98) forming the mould surface (14); a base part (66, 92); a third part of a third material interposed between the first (70, 98) and base parts (66, 92), the third part being in the form of a relatively thin layer, the third material being of a type to form metallic bonds, respectively with the first material and the material of the base part (66, 92); channels (64, 94) being provided in the upper surface of the base part (66, 92) which surface engages against the third part, the channels (64, 94) being such as to enable cooling fluids and/or heating elements to be contained therein.

66. A mould according to claim 65, characterised in that the third part is between 5 and 50μm thick.

67. A mould according to claim 66, characterised in that the third part is substantially 25μm thick.

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68. A mould according to any of claims 65 to 67, characterised in that the channels (64, 94) have a width and depth of between 2 and 10mm.

69. A mould according to any of claims 65 to 68, characterised in that the channels (64, 94) are lined with pipes (68, 96).

70. A mould according to claim 69, characterised in that the pipes (68, 96) are made of nickel.

71. A mould according to claim 69, characterised in that the pipes (68, 96) are made of copper or of stainless steel.

72. A mould according to claim 71, characterised in that the pipes (68, 96) are provided with a nickel coating on the outside thereof.

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73. A mould according to any of claims 66 to 73, characterised in that the first part (70, 98) and/or the base part (66, 92) are made of a tool or mould steel.

74. A mould according to claim 73, characterised in that the base part (66, 92) is made of a lower grade material.

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75. A mould according to any of claims 65 to 74, characterised in that the third material is nickel or a nickel alloy.

76. A mould according to any of claims 65 to 75, characterised in that a second part (76, 102) is provided on the surface of the base part (66, 104).

77. A mould according to claim 76, characterised in that the second part (76, 102) comprises a material of greater thermal conductivity than the first material.

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78. A mould according to claims 76 or 77, characterised in that a layer of third material is provided between the second part (76, 102) and the base part (66, 104).

79. A mould according to any of claims 76 to 78, characterised in that the second part (76, 102) is in the form of a substantially uniform thickness layer.

80. A mould according to claim 77, characterised in that the second part (76, 102) is between 0.5 and 15mm thick.

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81. A mould according to any of claims 76 to 80, characterised in that the second material comprises copper or a copper alloy.

82. A mould according to any of claims 65 to 81, characterised in that the first part (70, 98) is in the form of a substantially uniform thickness layer.

83. A mould according to claim 82, characterised in that the layer is between 1 and 8mm.

84. A method of forming a mould according to any of claims 65 to 83.

85. A method according to claim 84, characterised in that the first part (70, 98) is formed by machining a block of first material to a depth corresponding to the final thickness of the first part (70, 98) below the eventual mould surface; the base part (66, 92) is formed to correspond to the shape of the machined surface of the block of first material, a continuous slot is machined in the surface of the base part (66, 92), the third part is provided between the first (70, 98) and base (66, 92) parts which are joined by hot isostatic pressing; the first part (70, 98) is subsequently machined to provide the mould surface (14).

86. A method according to claim 85, characterised in that the slots (64, 94) are lined with pipes (68, 96).

87. A method according to claims 85 or 86, characterised in that the slots are lined with pipes (68, 96) which during the hot isostatic pressing expand to fill the slots (64, 94).

88. A method according to claims 85 or 86, characterised in that the pipes (68, 96) are filled with a sacrificial powder such as graphite which is subsequently removed.

89. A method according to any of claims 84 to 88, characterised in that where a second part is provided between the first and base parts, the second part is located therebetween prior to pressing.

90. A method according to claim 89, characterised in that the second part is formed by casting, machining, electroplating on to the first or third part, or by filling the space between the first and base parts with powdered second material which bonds together during hot isostatic or uniaxial pressing.